Giant Bacteria Colonise the Oceans

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UXBRIDGE, Canada – A mat the size of Uruguay composed of giant bacteria has been discovered in the mid-depths of the ocean off the coasts of Chile and Peru, report scientists who are working on a series of studies of the ocean's smallest life forms.

These enormous spaghetti-like mats of megabacteria (Thioploca spp.) may play a key role the region's extremely rich fisheries, says marine biologist Víctor Ariel Gallardo, vice-chair of the Census of Marine Life Scientific Steering Committee, which released the preliminary results of its survey in early April.

Some 2,000 scientists from more than 80 nations are participating in the Census, one of the biggest global collaborations undertaken.

The Census concludes its 10-year exploration, research and recording of marine life – past and present – in October.

"Some 50 percent of the world's fish catch comes from fisheries off the west coast of South America, where the biggest of these bacterial mats are found," Gallardo told Tierramérica from Santiago, where he moved after his home and laboratory in Concepción were destroyed by the tsunami triggered by the Feb. 27 earthquake.

While the largest mats, extending more than 130,000 square kilometres (Uruguay is 170,000 sq km), are found off Chile and Peru, smaller mats have been found off the west coast of Namibia in southern Africa, another region known for its abundant fish stocks.

The megabacteria were discovered in the cold Chilean waters in the 1960s, but, Gallardo said, few scientists could believe at the time that a bacterium could measure two to seven centimetres – big enough to see with the naked eye.

The discovery that these giant bacteria also live in vast colonies is more recent, and it has only been in the past couple of years that funding has been available through the Census of Marine Life to finally investigate this surprising abundance.

These bacteria have a very old lineage, stretching back as much as 2.5 billion years to a time when the oceans contained no oxygen. At that time megabacterial mats may have blanketed the entire ocean, Gallardo said.

"There are fossils of bacteria from that time that are very similar to what we find now," explained the Chilean scientist.

These bacterial mats may be remnants of that Proterozoic period 2.5 billion to 650 million years ago, surviving in the oxygen-starved mid-depths of the ocean.

Such oxygen-minimum layers exist in parts of the world's oceans where little of this gas mixes down from the surface or up from the cold, oxygenated water that sinks at the poles and oozes like poured cream along the sea floor to other world regions.

In the most extreme oxygen-starved layers is where the megabacteria thrive, living off hydrogen sulphide, a toxic gas that is produced when organic matter breaks down in the absence of oxygen.

Only microbes can survive there. Where this layer meets the continental shelf they have formed the enormous mats of multicellular filaments on the muddy bottom 50 to 200 metres below the surface.

The giant bacteria have also been detected in sulphide seeps at the Galápagos Archipelago, Ecuador, and off the Pacific coasts of Panamá and Costa Rica. Investigators speculate that these microbial mats in low-oxygen layers may extend from southern Chile to Colombia and may be present under all of the oxygen minimum layers of the world's oceans.

Microbial ecosystems comprise 50 to 90 percent of all ocean biomass and are responsible for more than 95 percent of respiration in the oceans.

In fact, microbes maintain the planet's habitability. They regulate the composition of Earth's atmosphere, influence climate, recycle nutrients, and decompose pollutants by turning atmospheric carbon dioxide absorbed by the ocean back into carbon to be sunk to the depths. Likewise with nitrogen, sulphur, iron and manganese, among other elements.

The rising acidity of the oceans due to increasing emissions of carbon dioxide into the atmosphere from burning fossil fuels may affect marine microbes. Scientists are currently testing their sensitivity.

Fifty years ago, scientists estimated that about 100,000 microbial cells inhabited one litre of seawater. Now, more than one billion microorganisms are estimated to be in a litre of seawater or one gram of seabed mud.

"We have badly underestimated microbial diversity," said Paul Snelgrove, a marine biologist at Memorial University in Newfoundland, Canada.

It is the same for other hard-to-see marine organisms like zooplankton, larvae, and the crustaceans and worms that burrow in the seabed, which collectively underpin almost all other life on Earth.

One study that looked at an area of the deep ocean no bigger than the size of a small bathroom found 700 new species of crustaceans, Snelgrove told Tierramérica.

"That discovery is not surprising for those of us who work in the deep sea because there is so much diversity there. But we have a lot of work ahead of us to understand what's there and their functions," he added.

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